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(54) Abstract Title

WELDED COUPLING FOR SEALING A PIPE TO A WALL

(57) A fitting for providing a substantially fluid-tight seal between an opening in a chamber wall 10 and a pipe 4 passing through said opening, said fitting comprising:-

(i) a tubular sleeve 22 adapted to pass through the opening in the chamber wall 10 and further adapted to allow the pipe to pass through the sleeve;

(ii) a flange, 24 extending radially outwardly from the sleeve, a first surface of the flange being configured to contact the chamber wall around substantially the whole circumference of the opening and over substantially the whole first surface of the flange;

(iii) a first energy transfer means 28 incorporated in the flange and situated at or near the first surface of the flange, said energy transfer means being adapted to heat the first surface of the flange in order to form a substantially fluid tight seal between the wall and the flange;

characterised in that at least part of the tubular sleeve is a tight sliding fit with the pipe passing through it and in that that part of the sleeve incorporates a second energy transfer means 38 adapted to form a substantially fluid tight seal between the sleeve and the pipe.

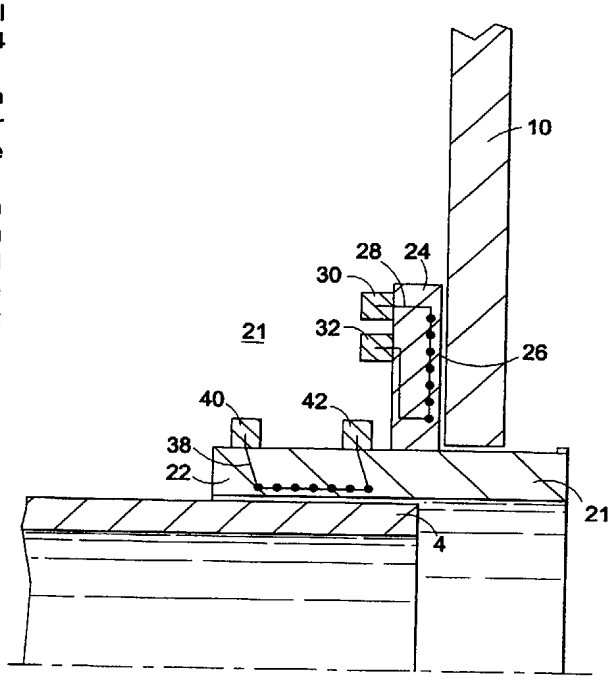

Fig.2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

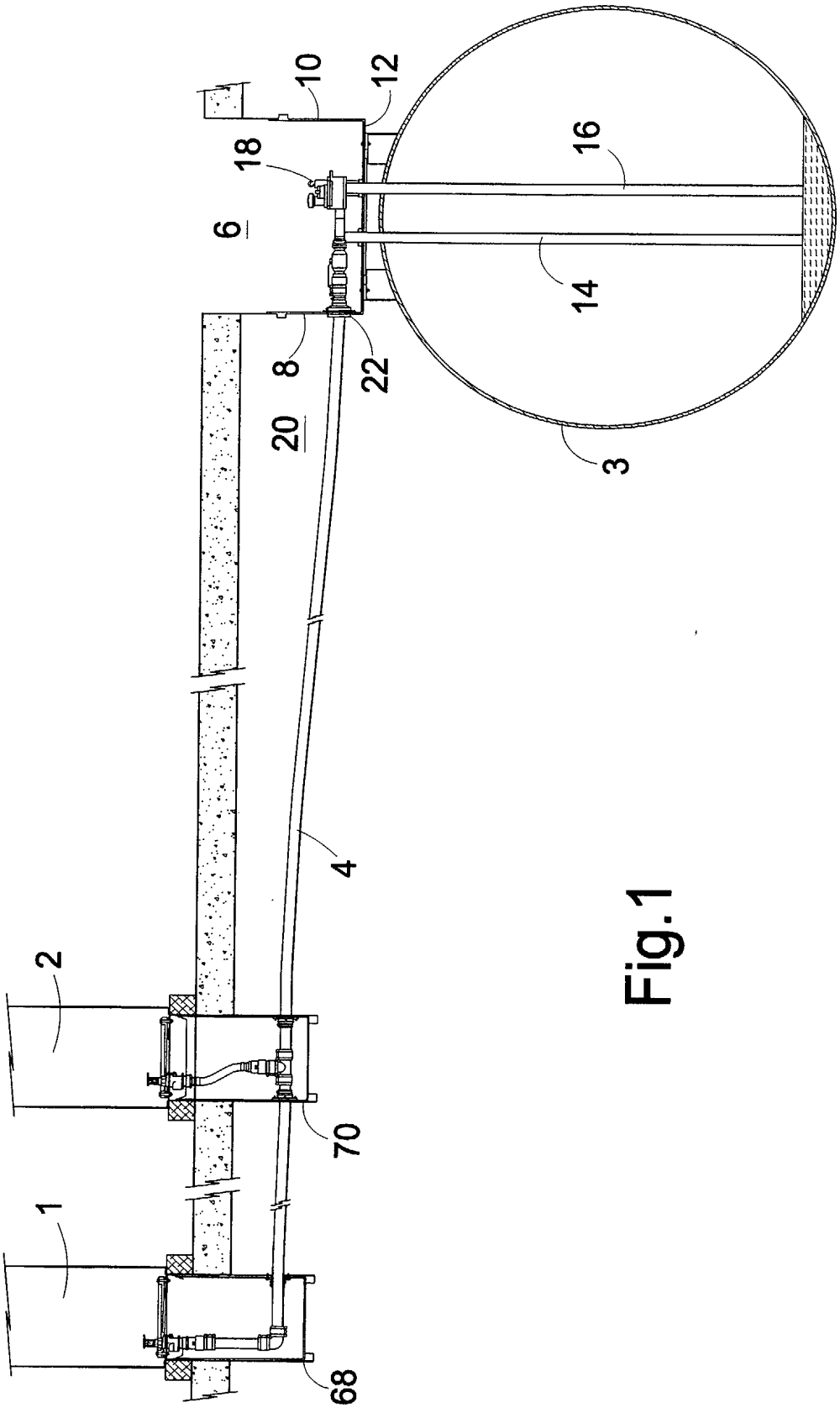


Fig.1

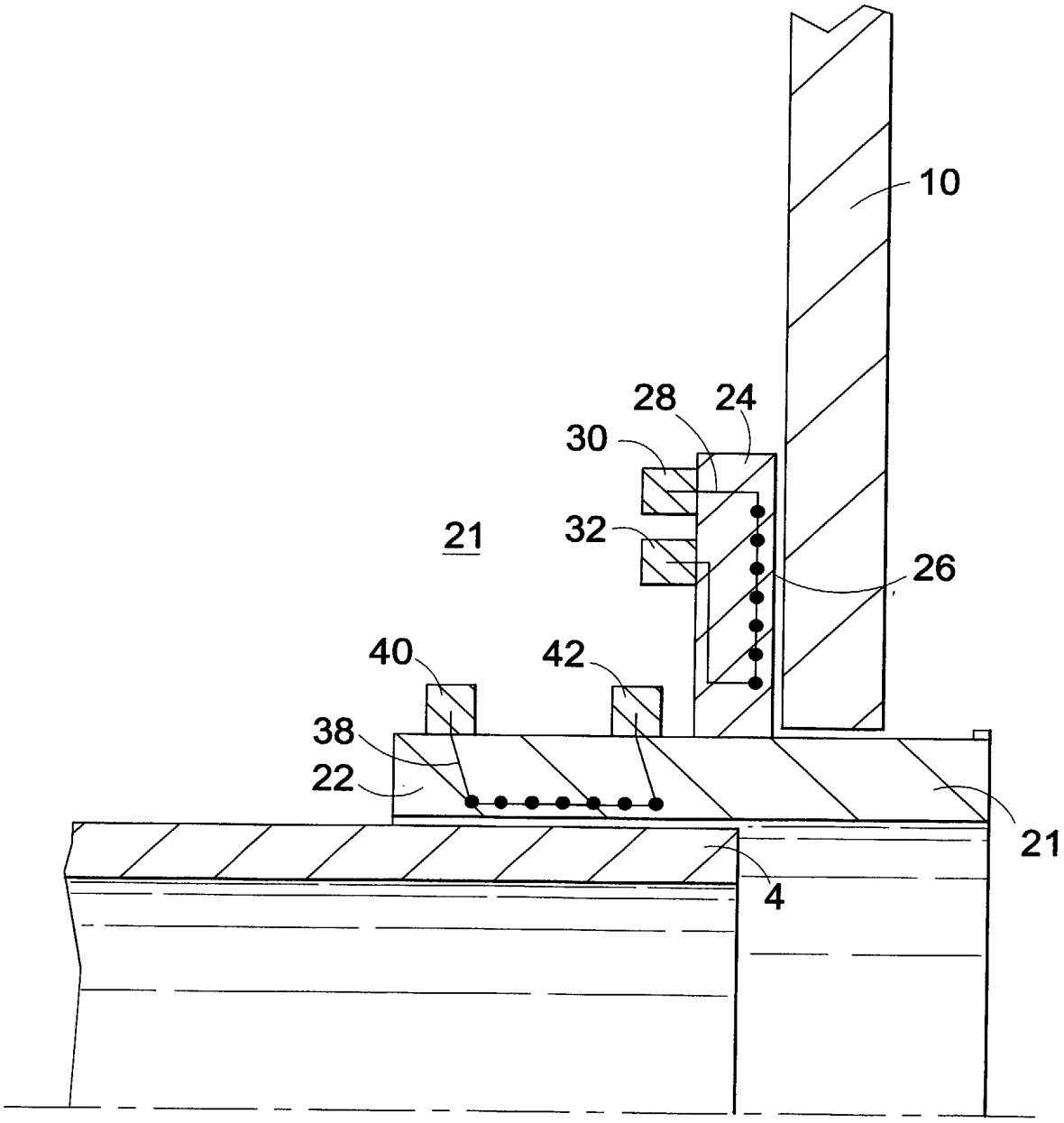


Fig.2

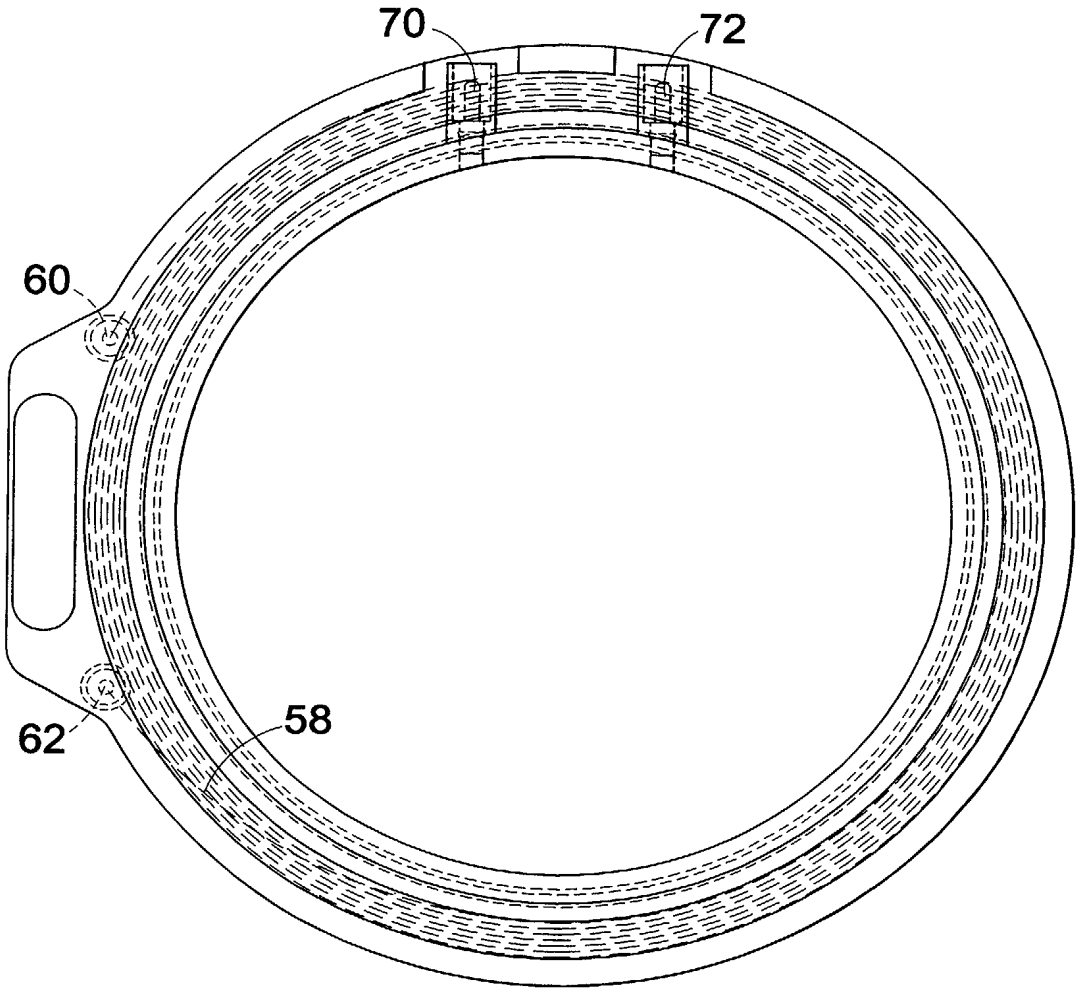


Fig.3

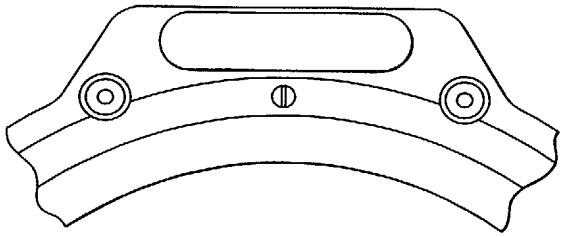


Fig.4

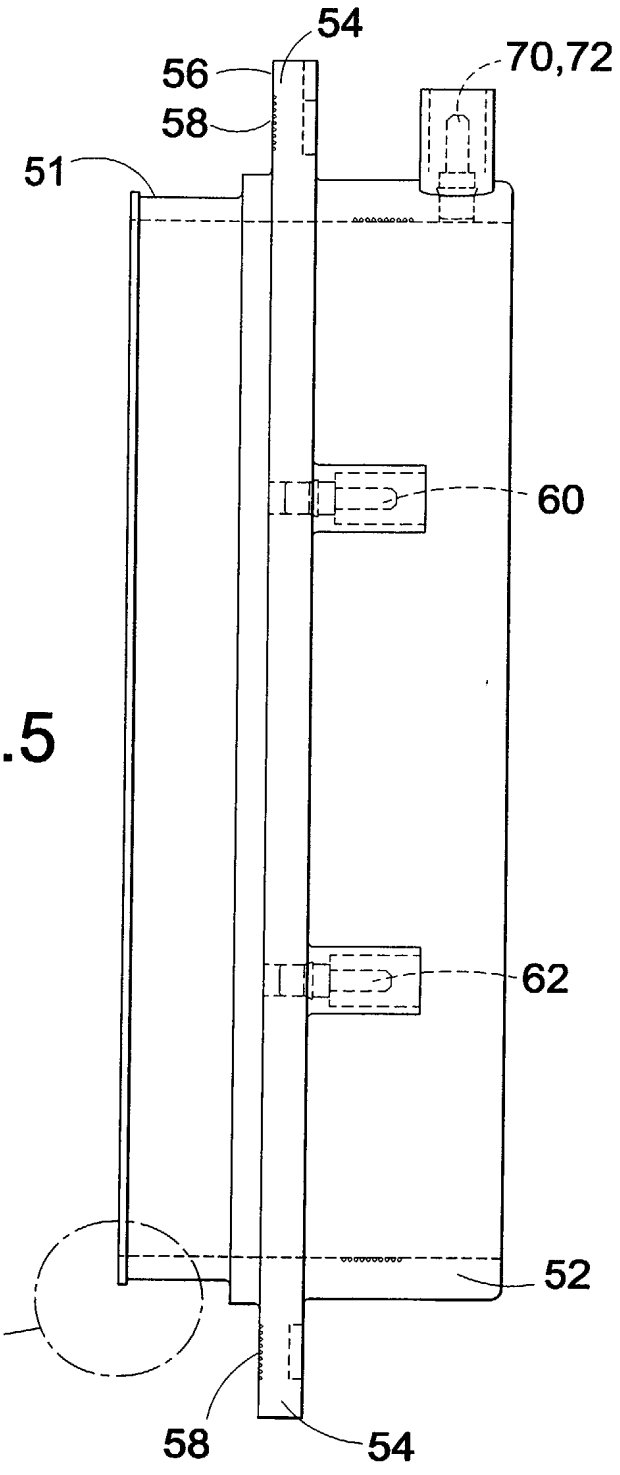
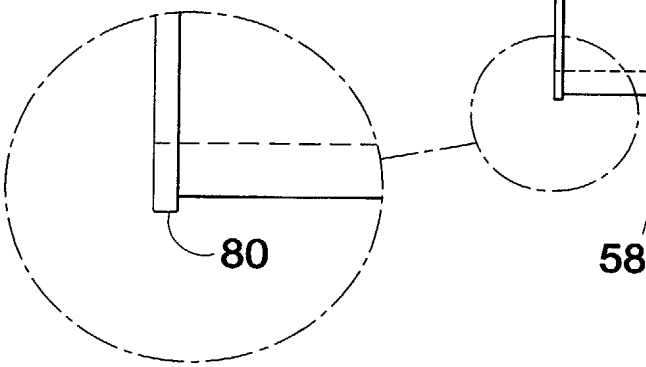


Fig.5

Fig.6



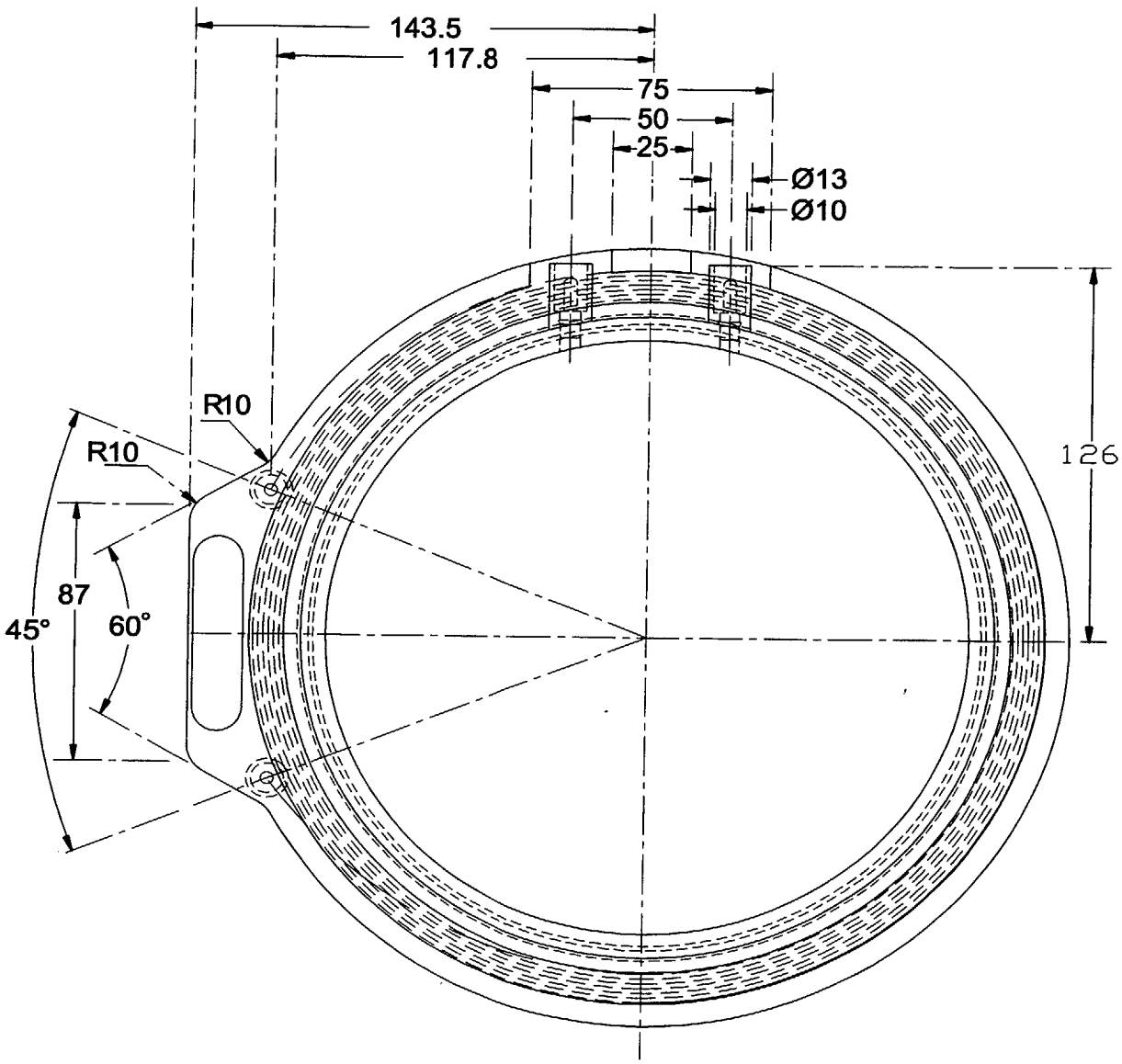


Fig.7

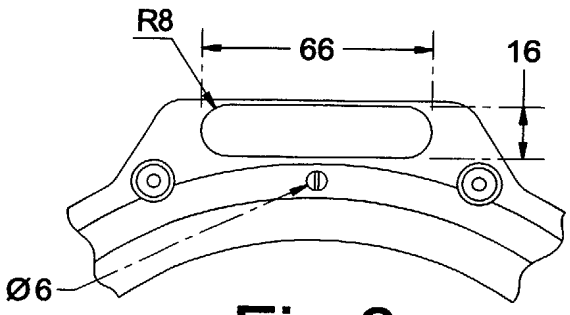
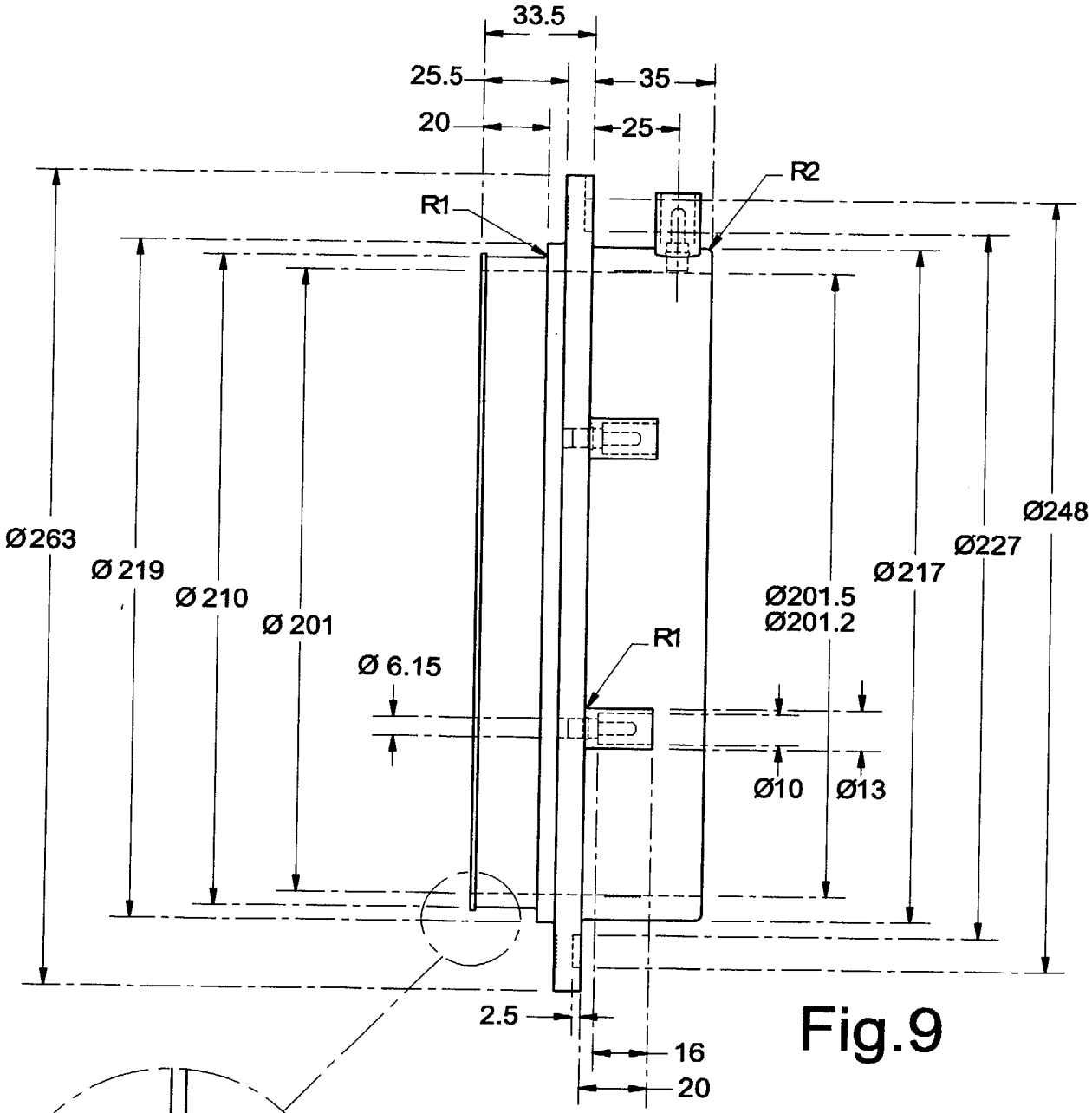


Fig.8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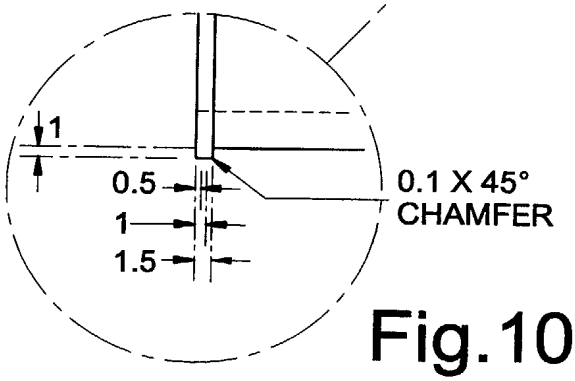
25.5
35
20
25
R2
R1
Ø263
Ø 219
Ø 210
Ø 201
Ø 6.15
R1
Ø201.5
Ø201.2
Ø217
Ø227
Ø248
Ø10
Ø13
2.5
16
20

Fig.9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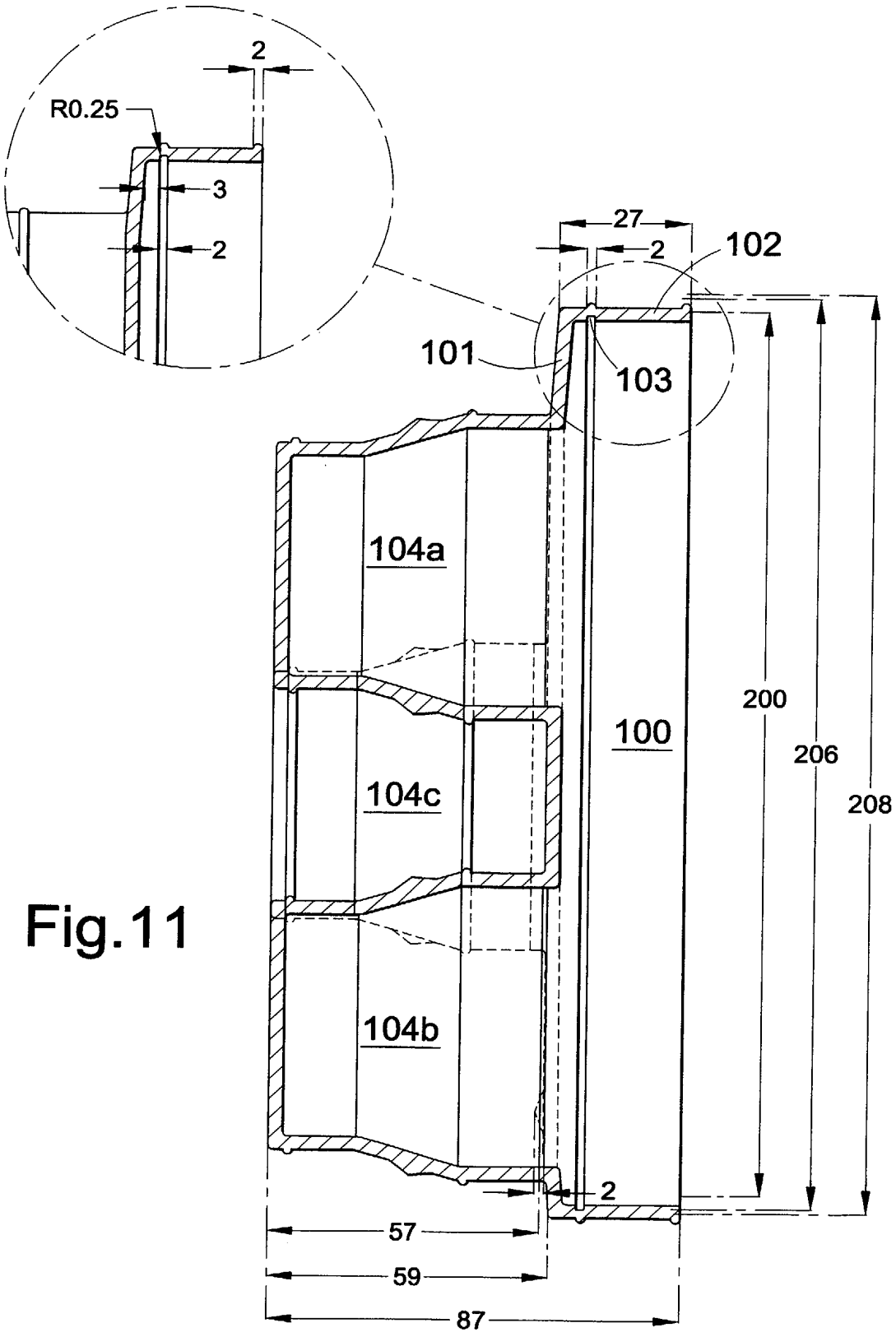
0.5
1
1.5
0.1 X 45°
CHAMFER

Fig.10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R0.25
3
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27
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101
103
104a
104c
104b
100
200
206
208
2
57
59
87

Fig.11

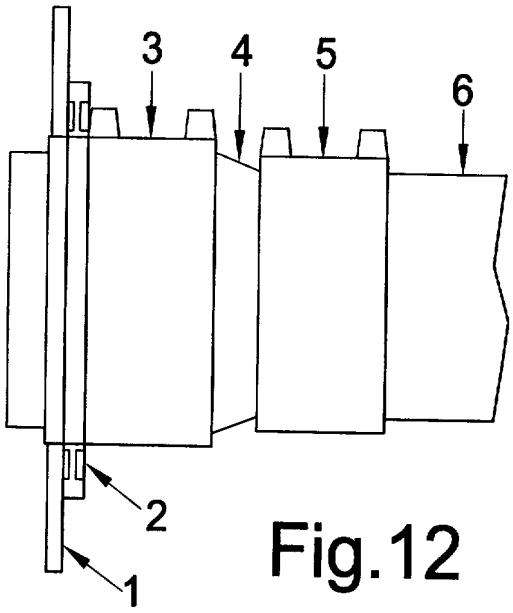

Fig.12

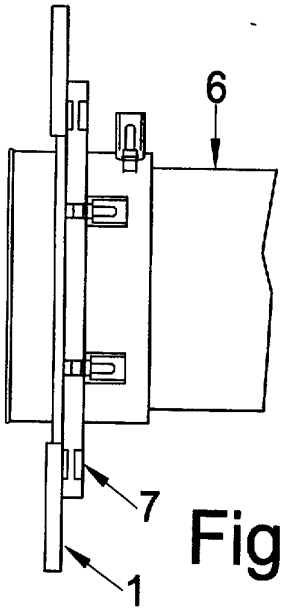

Fig.13

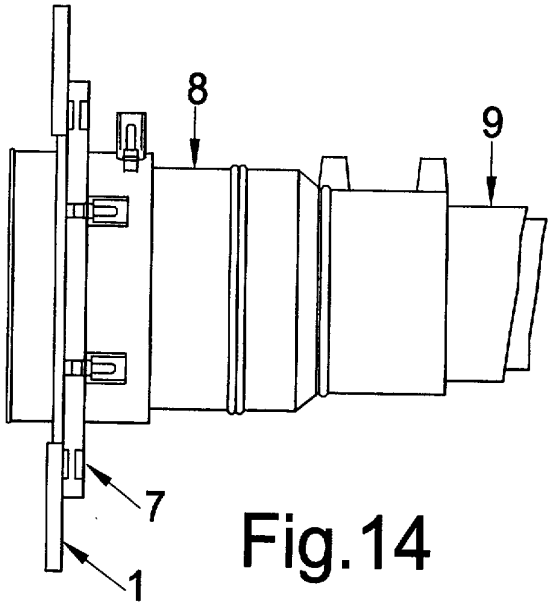

Fig.14

Item	Description
1	PE Chamber Wall
2	UPP Electrofusion Seal - 300 Series
3	UPP 125mm Secondary Containment Welding Socket
4	UPP 125mm/110mm Secondary Containment Reducer
5	UPP 110mm Secondary Containment Welding Socket
6	UPP Secondary Containment 110mm Pipe
7	UPP 305 Intergrated Seal & 110mm SC Welding Socket
8	UPP 110mm/75mm Secondary Containment Sliding Reducer
9	UPP 75/63mm Co-axial Lined Pipe

Key to Figures 12,13 and 14

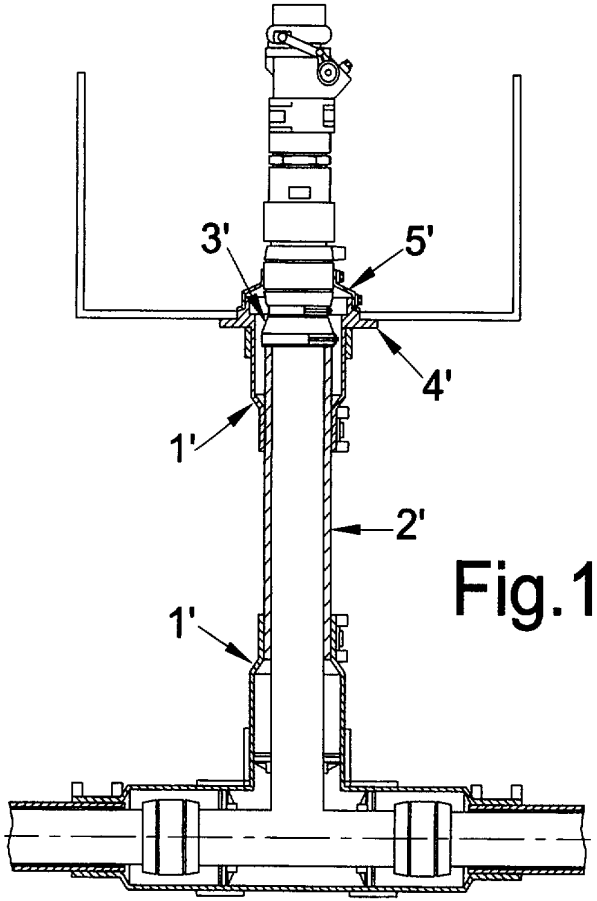

Fig.15

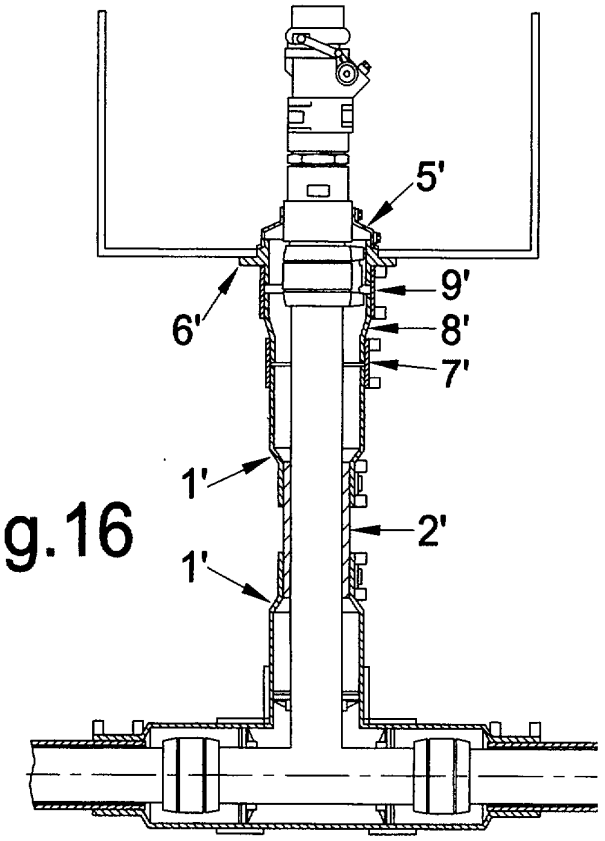

Fig.16

Item	Description
1'	UPP 110mm/75mm Secondary Containment Sliding reducer
2'	UPP 75mm Secondary Containment Pipe
3'	UPP 75mm/63mm Secondary Terminating Boot
4'	UPP 305 Intergrated Seal & 110mm SC Welding Socket
5'	UPP 125mm/90mm Secondary Terminating Boot
6'	UPP Electrofusion Seal - 300 Series
7'	UPP 110mm Secondary Containment Welding Socket

Key to Figures 15 and 16

COUPLING

Field of the Invention

This invention relates to fittings for providing a seal between a wall and a pipe passing through an opening in the wall, to a method of providing such a seal, and to an assembly comprising the combination of a pipe, a wall and a fitting providing a seal between the two. The invention is particularly applicable, but in no way limited, to the provision of a seal between a pipe and a wall of a manhole chamber as found in a subterranean fuel tank chamber or pump/dispenser for a sump, for example in a petroleum forecourt installation.

Background to the Invention

In petroleum forecourt installations, pipework running between dispensing pumps and a subterranean fuel storage tank passes into a manhole chamber which is generally situated directly above the manhole lid of the tank. The chamber is normally defined by an upstanding wall which, when viewed from above, can be of an octagonal, circular, square or rectangular shape, and which includes apertures through which respective pipes pass.

It is desirable to provide a seal between each of the apertures and its respective pipe to avoid ingress of water into and out of the manhole chamber. To that end, it is known to attach a fitting to a portion of the wall around the aperture and a rubber "boot" that sleeves over the pipe and is clamped to both the pipe and the fitting by, for example, jubilee (TM) clips. Some types of fitting are bolted to the chamber wall, whilst other types of fitting provide inner and outer parts between which the wall is sandwiched, the inner and outer parts being held together by a screw-threaded connector which extends through the aperture. These connectors often incorporate a rubber seal located between a part of the connector and the

chamber wall. Similar fittings are used in the sumps situated beneath the dispensing pumps.

A further fitting of this general type is described in GB2 332 255 (PetroTechnik Ltd). The entire text of this document is incorporated herein by reference and is intended to form an integral part of this disclosure. This describes a fitting comprising a tubular sleeve which passes through the chamber wall and a flange extending radially outwards from the sleeve, the flange incorporating electrofusion heating elements. In use the flange is welded to the chamber wall and a fluid tight seal between the sleeve and a pipe passing through it is completed using a conventional rubber boot.

The rubber boots used in prior art chamber to pipe couplings of the type described above have a finite life. Eventually they perish, soften, or show signs of wear and have to be replaced. This is a labour intensive job and requires that the forecourt installation is closed to customers. So not only is there a maintenance cost to bear but there are also lost revenues.

Additionally, however well constructed, a rubber boot can never be as strong as the plastic components used to construct the plastic pipework or the associated chambers and sumps. Thus prior art couplings have relied for their seal on an inherently weak component.

It is an object of the present invention to provide a fitting which overcomes or mitigates some or all of the above disadvantages.

Summary of the Invention

According to a first aspect of the present invention, there is provided a fitting for providing a substantially fluid-tight seal between an opening in a chamber wall and a pipe passing through said opening, said fitting comprising:-

(i) a tubular sleeve adapted to pass through the opening in the chamber wall and further adapted to allow the pipe to pass through the sleeve;

(ii) a flange, extending radially outwardly from the sleeve, a first surface of the flange being configured to contact the chamber wall around substantially the whole circumference of the opening and over substantially the whole first surface of the flange;

(iii) a first energy transfer means incorporated in the flange and situated at or near the first surface of the flange, said energy transfer means being adapted to heat the first surface of the flange in order to form a substantially fluid tight seal between the wall and the flange;

characterised in that at least part of the tubular sleeve is a tight sliding fit with the pipe passing through it and in that the part of the sleeve adapted to be in sliding fit contact with the pipe incorporates a second energy transfer means adapted to form a substantially fluid tight seal between the sleeve and the pipe.

This arrangement negates the requirement to use a rubber boot and, for the first time, provides a fitting of this type where both seals are formed by electrofusion welding.

Specifically, this is the first fitting known to the applicant designed to create an electrofusion seal between a secondary containment pipe and the side of a chamber or sump wall.

Preferably the first surface of the flange comprises a fusible material which, when heated via the energy transfer means, at least partially melts, causing the fitting and the wall to be fused together.

In a particularly preferred embodiment the energy transfer means comprise conduction means for conducting an electric current, said conduction means in use

being heated by the current to cause heating of the surface in which the energy transfer means is situated.

The process by which two components are fused together as a result of electrical heating from a conductor (situated at or near the interface between the two components prior to fusing) is known as electrofusion. Electrofusion is normally used to provide seals at the join between two lengths of pipe, (particularly polyethylene pipe) in a pipeline. The same process can be used by a fitting in accordance with the present invention if the wall to which the fitting is to be fused is of a suitable thermoplastic material, such as polyethylene.

Preferably the fitting is adapted for use with a wall which is of a material which is not suitable for being attached to the fitting by electrofusion, the first surface of the fitting incorporating an adhesive of a type which is activated by heat, wherein the heating of the first surface by the energy transfer means activates the adhesive and thereby bonds the fitting to the wall. The adhesive can be a thermoplastic, thermoset, cross-linking or pressure sensitive adhesive.

Preferably the conduction means comprises heating wires which are embedded within the respective surface.

Preferably the sleeve is of a substantially circular cross-section, and the flange is radial.

Preferably the fitting includes terminals for connecting the conduction means to a current supply.

Preferably the internal diameter of the tubular sleeve is substantially uniform along substantially its whole length.

Preferably the fitting is reversible and can be fused to the inside or the outside of a chamber wall.

According to a second aspect of the present invention there is provided a method of forming a seal between an opening in a sump wall or in a chamber wall and a pipe passing through said opening using a fitting as described herein, said method comprising the steps of:-

(a) temporarily securing the fitting over the opening;

(b) applying energy to the first energy transfer means and thereby heating the first surface to cause the fitting to become fused or bonded to the chamber wall in a fluid tight manner;

(c) inserting a pipe through the sleeve;

(d) applying energy to the second energy transfer means and thereby heating the sleeve to cause the fitting to become fused to the pipe wall in a fluid tight manner.

Preferably the energy transfer means comprises conduction means for conducting an electric current, said conduction means in use being heated by the current to cause said heating of the first surface.

Preferably the materials constituting the wall and the first surface are such that their surfaces are fused together by a process of electrofusion.

In an alternative embodiment the method also includes providing an adhesive on the first surface which is activated by said heating to cause the fitting to be bonded to the wall.

Preferably the wall comprises a manhole chamber wall for a subterranean fuel tank and/or a sump chamber wall.

The fitting may advantageously be used in a manhole chamber for a subterranean fuel tank, having a pipe which passes through an aperture in the wall of the chamber, the fitting having a sleeve through which the pipe passes, the fitting being placed against the wall so as to surround the aperture, there being provided

energy transfer means for heating the fitting to cause the fitting and chamber wall to be fused or bonded together in a region which surrounds the aperture, and a second set of heating elements for sealing the pipe to the sleeve. The composite assembly so formed, including any rubber or elastomeric boot is also claimed.

Brief Description of the Drawings

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates a partially cut-away side view of part of a petroleum forecourt installation which includes a tank having a manhole chamber having a fitting of the type in question, together with two sumps having similar fittings;

Figure 2 is a diagrammatic view of a cross-section through one half of a fitting;

Figure 3 illustrates a side elevation of a fitting according to a second embodiment, showing a heating wire embedded in the flange of the fitting;

Figure 4 shows an enlargement of a part of the perimeter of the fitting with a code screw;

Figure 5 illustrates a side elevation of the fitting shown in Figure 3;

Figure 6 shows an enlarged view of the end edge of the sleeve;

Figures 7, 8, 9 and 10 show the fitting of Figures 3, 4, 5 and 6 including example preferred dimensions in millimetres; and

Figure 11 illustrates in cross-section a multi-entry boot of a type used with fittings according to the present invention with example preferred dimensions in millimetres;

Figure 12 shows an existing (prior art) configuration of fitting used to join a chamber/sump wall to a secondary pipe;

Figure 13 shows the equivalent configuration using a fitting according to the present invention;

Figure 14 shows a fitting according to the present invention used to connect a 75mm diameter secondary containment pipe to a chamber wall via a sliding reducer;

Figure 15 illustrates the space-saving advantage of using a fitting according to the present invention at the bottom of a chamber/sump over the corresponding known arrangement shown in Figure 16.

Definitions

In this context the following terms have the meanings given below in addition to their ordinary dictionary meanings:-

chamber – any receptacle designed to keep a fluid in or out. This includes, but is not limited to manhole and sump chambers as described herein. It also includes tanks in general.

energy transfer means – a generic term describing any form of energy source. Typically it takes the form of a resistance winding which heats up when an electrical current is passed through it. The term also encompasses other welding techniques including ultrasonic welding and induction welding.

flange – any collar suitable for attaching a fitting to a chamber wall. In the examples given the surface of the flange which contacts the chamber wall is substantially planar. However, it will be understood that the flange must conform to the profile of the chamber wall around the pipe inlet opening. Thus the flange can be formed in any suitable conformation to achieve the necessary contact with a flat or curved surface or even the corner of a container wall.

fluid – whilst the examples provided relate mainly to liquids, the term fluid refers to liquids, vapours and gases. For example, should a leak occur in a secondarily contained pipe in a garage forecourt installation then petroleum or petroleum vapour will collect in the manhole chamber. It is essential that this petrol vapour cannot escape through the wall of the chamber and into the surrounding ground. The technology of the present invention can be applied to pipework for conveying a wide range of fluids. It can be used for water, or for aqueous fluid streams, for solvents or for petroleum products. In this context the term petroleum has a broad meaning including any hydrocarbon-containing product. This includes petrol, gasoline, diesel, aviation fuel, fuel oil or LPG.

pipe – the examples given herein are for a generally circular cross-sectioned single wall pipe. However, the invention also covers other cross-sections such as box sections, corrugated and the like and secondarily contained pipes of the "pipe-within-a-pipe" type. In this case the sealing member for sealing the sleeve to the pipe will be rather more complex.

The invention also encompasses pipes which are not circular in cross-section.

With regards to pipe sizes, fittings according to the present invention can be made to any particular size, depending on market requirements. Whilst most of the following description centres on pipes suitable for petroleum forecourt installations, larger fittings for water or gas main supply lines are perfectly possible. On the other hand, very small versions are possible suitable for connection to electrical conduits. Size is in effect immaterial.

tubular sleeve - this term has a very broad meaning. It includes any projection from the flange which substantially encircles a pipe passing through the fitting and

which enables a seal to be made between the fitting and the pipe. The flange and sleeve need not be of unitary construction.

Description of the Preferred Embodiments

The present embodiments represent currently the best ways known to the applicant of putting the invention into practice. But they are not the only ways in which this can be achieved. They are illustrated, and they will now be described, by way of example only.

The petroleum forecourt installation shown in Figure 1 comprises a pair of dispensing pumps 1 and 2 connected to a subterranean tank 3 through a pipeline 4. The pipeline 4 is formed from contiguously arranged sections of polyethylene pipe and is usually a secondarily contained pipe. That is to say, the pipeline consists of an inner, primary supply pipe, lined with a fluid-impervious barrier if required, with the primary pipe contained within an outer secondary pipe. The pipeline 4 extends from the pumps 1 and 2 into a manhole chamber 6 immediately above the tank 3. The chamber 6 is defined by a polyethylene member 8 having a side wall 10 and a base 12.

Figure 1 shows two lines extending from the pipeline 4 into the tank 3. These lines relate to two alternative forms of fuel supply system and are both shown for the sake of completeness. In practice, only one of the lines would extend from the pipeline 4 into the manhole chamber 6. One of those lines is a suction line 14 which is used where the dispensing pumps 1 and 2 are fitted with suction pumps. The alternative line, reference 16, is a pressure line connected to the pipeline 4 via a pump 18 which is operable to propel fuel from the tank 3 to the pumps 1 and 2.

It can be seen from Figure 1 that the wall 10 has to be apertured in order to allow the pipeline 4 to pass into the chamber 6. In order to prevent water leaking

from the surrounding ground (here denoted by reference numeral 20) into the chamber 6 through the aperture, and in the event of a spillage to prevent fluid leaking into the environment, the pipe system, and in particular the secondary containment pipe, is sealed to the cylindrical wall 10 by means of a fitting 21, shown in more detail in Figure 2.

The fitting comprises a cylindrical sleeve 22 having an outwardly projecting radial flange 24 towards one end. The sleeve defines a central passage through which the pipe of the pipeline 4 extends. It can also be seen from Figure 2 that the sleeve extends through the aperture in the wall 10 so that the sleeve is at least partially accommodated within the chamber 6, whilst the flange 24 is situated outside the chamber. Alternatively the fitting may be reversed with the flange located inside the chamber. The precise location of the flange along the sleeve is not critical.

The flange 24 has a surface 26 which is flat, to enable the surface to be placed against the wall 10 as shown in Figure 2. Accordingly, the flange 24 makes contact with the wall 10 in a region which surrounds the opening through which the pipe 4 passes. A wire 28, or first energy transfer means, is embedded in the surface 26 in a generally spiral arrangement and the ends of the wire 28 are connected to electrical terminals 30 and 32.

A second wire or energy transfer means, heating element 38 is embedded in the inner surface of part of the sleeve 22. The region of the sleeve where the wire is embedded is a tight sliding fit with the pipe 4. Item 4 could also be a pipe fitting as well as the end of a pipe. The wire 38 is spirally wound around the inside of the sleeve. The ends of the wire are connected to electrical terminals 40 and 42.

Previous fittings have allowed for up to 10° of misalignment of the pipe with respect to the fitting. It has been a long held view in this area of technology that

provision for such misalignment was necessary. However, this is not the case with the present invention and it has unexpectedly been discovered that it is possible to align the pipe with the opening with sufficient accuracy that both flange and sleeve can be successfully electrofusion welded.

When the fitting (constituted by the sleeve 22 and flange 24) is installed, the flange 24 is initially pressed against the wall 10, preferably by means of a special clamp, and the terminals 30 and 32 connected to a source of electric current. The current passes through the wire 28, causing the latter to heat the adjacent surface of the flange 24 (and part of the tank 10), to cause the flange 24 and wall 10 to fuse together in a disc-shaped region which substantially surrounds the opening in the tank 10. This not only retains the fitting on the wall 10 but also provides a seal which substantially encircles the opening in the tank, and thus prevents water passing between the flange and the wall 10 through the opening of the latter into the chamber 6. The passage of any water which travels along the surface of the part of the pipe outside the chamber 6 will be blocked by the seal between the pipe and the fitting (see below). This seal also prevents any spillage within the chamber escaping to the outside.

If the chamber wall were to be made of fibreglass, a modified version of this fitting would be used. The modified version is identical to the version shown in Figure 2, apart from the inclusion of a layer of adhesive over the surface of the flange which would constitute the surface 26 on the flange 24 and which overlies the heating wire. The adhesive is a thermoplastic or cross-linking adhesive which, once heated, forms a bond between the flange 24 and the wall 10. Again, since the bond will surround the opening in the wall 10, it also acts as a liquid tight seal to prevent the ingress of water. The choice of adhesive will be determined by the materials specialist. This disclosure is intended to encompass all known adhesives

of a suitable type and those yet to be discovered.

Alternatively, either the flange 24 or wall 10 can carry a heat-activated adhesive if the wall 10 is of a material not suitable for electrofusion welding.

Alternative adhesives may also be used such as pressure/heat cured adhesives such as 3M Type DP 8005 or Type DP8010. Other types may also be used. As well as being activated by pressure curing of such adhesives may also be accelerated by heating. In this case the temperatures required are less than those necessary to create an electrofusion weld. Thus, some regulation of the current passing through the first energy transfer means will be required. Such current regulators are known per se and can be used to heat and maintain the surface bearing such heating element at a substantially constant temperature of preferably between 40°C to 80°C, more preferably at approximately 50°C.

There is an alternative method for forming a weld between flange 24 and the wall 10 where the flange and wall are both substantially planar in the region of the weld. By spinning the fitting at high speed with the flange in contact with the wall, this creates sufficient heat due to frictional forces that the two components become welded together. Thus, in this example, the first energy transfer means is heat generated by contact between one surface revolving in frictional contact with the other.

Once a seal has been formed between the wall 10 and the fitting 21 a pipe is inserted through the sleeve such that it extends as least as far for the section of the sleeve containing the heating element 38. Terminals 40 and 42 are connected to a source of electric current and current passed through the element. This causes an electrofusion weld between the fitting 21 and the pipe 4 to complete the fluid-tight seal.

A similar heat activated adhesive of any of the types described above can be

used to form a bond between the sleeve 22 and pipe 4. This is particularly advantageous if the two components are made of different materials and do not form a satisfactory or reliable electrofusion weld.

Fittings according to the present invention can be formed from any suitable material as selected by the materials specialist. Preferably the fittings are formed from a thermoplastic material such as polyethylene. In a particularly preferred embodiment they are formed as a single unit by turning or casting.

Methods of laying a wire into a flat surface are known, for example by Rutland Plastics (RTM) Ltd, and can be applied here without substantial modification.

Figures 4 to 7 illustrate a fitting according to a second embodiment. Accordingly, referring primarily to Figure 5, the fitting comprises a flange 54, adapted to contact the wall around an aperture (not shown) through which a pipe passes. For clarity, this pipe is not shown. A wire 58 is embedded in surface 56 in a generally spiral shape as shown in Figure 3 and the ends of the wire are connected to terminals 60 and 62.

A cylindrical sleeve 52 extends substantially at right angles to the flange 54. This sleeve forms a passageway through the fitting and part of the sleeve is designed to be a tight sliding fit with the outer surface of the pipe to be accommodated. This will generally be the outer secondary pipe of a supply pipe system. A second wire or heating element 68 is embedded in the inner surface of sleeve 51 and the ends of this wire are connected to electrical terminals 72 and 72. This arrangement allows, for the first time, a secondary pipe to be electrofusion welded to a chamber wall. The welds between the flange and the chamber wall and the sleeve and the pipe are generally carried out in a stepwise manner. The method of fixing this fitting is similar to that described above.

The fitting also includes a second sleeve 51 which extends away from the flange 54 substantially at right angles on the opposite side of the flange to sleeve 52. It will be seen from Figure 5 that the internal diameter of sleeve portion 51 is larger than the corresponding diameter of sleeve portion 52. This is perfectly possible and the internal diameter of sleeve portion 51 may be small or larger than the internal diameter of sleeve portion 52 as desired.

An important feature is the protrusion 80 associated with the outer end edge circumference of sleeve 51. This is shown more clearly in Figure 6. Where this fitting is used to secure a secondary pipe to a chamber/sump wall in a fluid-tight fashion then the primary pipe within the secondary must also be sealed to it in a fluid-tight fashion. This is generally done using a rubber or elastomeric boot. Where multiple primary pipes are contained within a single secondary pipe then multiple entry boots are required. Such boots are described in GB 0222253.7, the entire text of which is incorporated herein by reference. It is intended that the imported text forms an integral part of this disclosure.

The duct termination boot 100 illustrated in Figure 11 comprises a one piece moulding that is suitably of an elastomeric material such as rubber. The boot 100 has a main body 101 which here has the shape of a substantially flat circular plate with an upstanding annular rim 102. The annular rim 102 is circular cylindrical to fit snugly around outer circumferential wall of the end of a pipe or duct on which the duct termination boot is installed in use.

A broad recess filling a major part of the width of the annular rim 102 is provided to receive the spring steel ring of a jubilee-type clamp for fastening the rim 101 to the duct.

Further provision for securing the rim 101 in place to the end of the duct or to a thermofusion/electrofusion seal plate mounted at the end of the duct may be by

providing a circumferential groove or indentation 103 on the inner surface of the annular rim 102. Groove 103 is designed to be a complementary fit with protrusion 80.

Protruding from the front face of the planar plate-like main body portion 101 of the boot 100 are a set of three end cap portions 104 a-c. These end cap moulding portions 104 a-c are integrally moulded with the main body portion 101 and are sized and configured to fit over respective primary pipes carried within the secondary pipe/duct on which the duct termination boot 100 fits in use.

Returning to Figure 6, the protrusion 80 is so sized, shaped and positioned that it engages within a corresponding circumferential indentation or groove within such a boot. Once the boot has been clamped in place this lock-and-key type arrangement provides a considerably greater resistance to the boot becoming displaced than in earlier, prior art boots.

The result of this invention is that it has unexpectedly been discovered that it is possible to design a fitting adapted to join a secondary pipe passing through a chamber wall to that chamber wall by electrofusion welding and wherein the resultant seal is a substantially stronger seal and, importantly, considerably more compact, than had hitherto been possible. Furthermore, by a relatively low cost modification of introducing a protrusion around the outer end circumference of the fitting sleeve which extends into the chamber, and a corresponding groove within the rubber boot, the seal between the fitting and the rubber boot required to complete the assembly is also substantially stronger and more robust than in prior art designs.

The benefit of the compactness of fittings according to the present invention can be seen more clearly from Figures 12 to 15 inclusive. Referring to Figures 12 to 14, Figure 12 illustrates one current, known method of forming a seal between a

chamber wall 1 and a secondary containment 110mm pipe. It will be seen from the key that an electrofusion seal 2, a welding socket 3, a reducer 4 and a further welding socket 5 are all required. That is a total of four components excluding the pipe 6 and chamber wall 1. This should be compared with Figure 13 which shows that these four components can be replaced by a single fitting 7 according to the present invention. There is thus a considerable saving in cost and more particularly in time in forming such a connection. In addition there is a significant reduction in the changes that one of the components or one of the welds might fail. Figure 14 shows how a fitting according to the present invention 7 can be used to connect a somewhat smaller 75mm secondary pipe 9 via a sliding reducer 8 to a chamber wall 1.

It will be appreciated from Figures 12 and 14 that fittings according to the present invention result in a very compact joint. This can be extremely beneficial in certain circumstances, one instance of which is shown in Figure 15 and 16. Both figures illustrate a secondary contained supply pipe running below a chamber/sump with a T-fitting providing a supply into the chamber. In Figure 16 an existing configuration is shown which requires eight components as specified by the key to Figures 15 and 16. It should be noticed that even with a very short section of secondary containment pipe 2^1, there is a considerable distance required between the supply pipe running horizontally and the bottom of the chamber. This distance cannot be reduced further.

This arrangement should be compared with that shown in Figure 15, which utilizes a fitting according to the present invention. This utilizes only five essential components as shown in the key. Importantly, the portion of secondary containment pipe 2^1 is now much longer. This means that by reducing this length the supply pipe can run at a much shallower depth under the chamber. This has

major cost and time implications when constructing a large forecourt with multiple dispensing pumps. In addition, because each joint takes a considerable time, and therefore cost, to make in construction, there is a major cost saving in reducing the number of joints overall.

The present invention also encompasses a method of fixing a pipe to a chamber or sump wall as described above and the combination of apparatus that results from operating said method.

CLAIMS

1. A fitting for providing a substantially fluid-tight seal between an opening in a chamber wall and a pipe passing through said opening, said fitting comprising:-

(i) a tubular sleeve adapted to pass through the opening in the chamber wall and further adapted to allow the pipe to pass through the sleeve;

(ii) a flange, extending radially outwardly from the sleeve, a first surface of the flange being configured to contact the chamber wall around substantially the whole circumference of the opening and over substantially the whole first surface of the flange;

(iii) a first energy transfer means incorporated in the flange and situated at or near the first surface of the flange, said energy transfer means being adapted to heat the first surface of the flange in order to form a substantially fluid tight seal between the wall and the flange;

characterised in that at least part of the tubular sleeve is a tight sliding fit with the pipe passing through it and in that that part of the sleeve incorporates a second energy transfer means adapted to form a substantially fluid tight seal between the sleeve and the pipe.

2. A fitting according to Claim 1, in which the first surface of the flange comprises a fusible material which, when heated via the energy transfer means, at least partially melts, causing the fitting and the wall to be fused together.

3. A fitting according to either Claim 1 or Claim 2, in which the energy transfer means comprise conduction means for conducting an electric current, said conduction means in use being heated by the current to cause heating of the surface in which the energy transfer means is situated.

4. A fitting according to Claim 1 or Claim 3 when dependent on Claim 1, in which the fitting is adapted for use with a wall which is of a material which is not suitable for being attached to the fitting by electrofusion, the first surface of the fitting

incorporating an adhesive of a type which is activated by heat, wherein the heating of the first surface by the energy transfer means activates the adhesive and thereby bonds the fitting to the wall.

5. A fitting according to Claim 4, in which the adhesive is selected from a thermoplastic, thermoset, cross-linking or pressure sensitive adhesive.

6. A fitting according to Claim 3, or Claim 4 or Claim 5 when dependent on Claim 3, in which the conduction means comprises heating wires which are embedded within the respective surface.

7. A fitting according to any preceding claim, in which the sleeve is of a substantially circular cross-section, and the flange is radial.

8. A fitting according to Claim 3 or Claim 6, in which the fitting includes terminals for connecting the conduction means to a current supply.

9. A fitting according to any preceding claim in which the internal diameter of the tubular sleeve is substantially uniform along substantially its whole length.

10. A fitting according to any preceding claim wherein the fitting is reversible and can be fused to the inside or the outside of a chamber wall.

11. A fitting according to any preceding claim wherein the sleeve extends on both sides of the flange and on the outer end edge of the sleeve on the end of the sleeve, furthest from the second energy transfer means there is provided a protrusion adapted to engage with a correspondingly shaped indentation in a rubber boot adapted to fit over the sleeve.

12. A fitting substantially as herein described with reference to, and as illustrated in the accompanying drawings.

13. A fitting assembly comprising a fitting as described in any preceding claim, a chamber and a pipe together with an elastomeric boot.

14. A fitting assembly as claimed in Claim 13 wherein the elastomeric boot incorporates an indentation so sized, shaped and positioned that it co-operatively engages with a protrusion on the outer surface of the sleeve of the fitting.

15. A method of forming a seal between an opening in a sump wall or in a chamber wall and a pipe passing through said opening using a fitting according to any of Claims 1 to 12 inclusive, said method comprising the steps of:-

(e) temporarily securing the fitting over the opening;

(f) applying energy to the first energy transfer means and thereby heating the first surface to cause the fitting to become fused or bonded to the chamber wall in a fluid tight manner;

(g) inserting a pipe through the sleeve;

(h) applying energy to the second energy transfer means and thereby heating the sleeve to cause the fitting to become fused to the pipe wall in a fluid tight manner.

16. A method according to Claim 15, in which the energy transfer means comprises conduction means for conducting an electric current, said conduction means in use being heated by the current to cause said heating of the first surface.

17. A method according to Claim 15 or Claim 16 in which the materials constituting the wall and the first surface are such that their surfaces are fused together by a process of electrofusion.

18. A method according to Claim 15 or Claim 16, in which the method also includes providing an adhesive on either or both of the first surface or the second

surface which adhesive is activated by said heating to cause the fitting to be bonded to the wall or to the pipe or to both.

19. A method according to any of Claims 15 to 18 inclusive, in which the wall comprises a manhole chamber wall for a subterranean fuel tank and/or a sump chamber wall.

20. A method of forming a seal between an opening and a pipe substantially as herein described.

Application No:	GB 0222949.0	**Examiner:**	David Harness
Claims searched:	GB 0222949.0	**Date of search:**	28 April 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	1-20	GB 2332255 A (PETROTECHNIK LIMITED) See whole document.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

B5K, F2G

Worldwide search of patent documents classified in the following areas of the IPC[7] :

F16L

The following online and other databases have been used in the preparation of this search report :

WPI, EPODOC PAJ